Teaching Students with Disabilities Literacy Through Technology

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Abstract

This review of research focuses on technological intervention methods as an alternative way to teach literacy to students with disabilities. It discusses the current emphasis of integrating students with specific learning needs in the general education curriculum and the fact that they are struggling, especially in the area of literacy. Through various articles, this review highlights certain technology that strives to address students with disabilities' needs as well as the effectiveness of these technologies. Technology is also discussed in the framework of Response to Intervention (RTI) along with devices that are specific to certain areas of literacy. Furthermore, a variety of technology that addresses more narrow learning needs, such as physical and learning disabilities are presented. Due to the fact that educators struggle in integrating technology with their instruction, guidelines for how to do so effectively are recommended to provide a springboard for combining the two facets of literacy and technology for these unique learners. In terms of technology that can aid these students in the future, devices and software to help older learners with disabilities are also evaluated to offer a comprehensive examination of what technology attempts to offer.

One of the most pressing issues in today's education is how to integrate students with disabilities into the general education environment as much as possible and how to do so effectively. In 2005, according to the National Center for Educational Statistics, 50% of students with special needs between the ages of 6 and 21 spent at least 80% of their time in the general education setting (Michael & Trezek, 2006). However, with the increase in mainstreaming these students initiated the realization that they are underperforming compared to their peers. In particular, literacy appears to be an area that requires immediate attention. In 2009, the National Assessment of Educational Progress (NAEP) found that only 6% of students with disabilities performed at a proficient level based on their writing test scores. Around 46% scored below a basic level, and 48% performed at a basic level (Smith & Okolo, 2010).

As a result, it is pertinent that educators use what they already know works for instructing students. The universal design approach is a highly valued technique where all students' needs are addressed in the overall curriculum's rationale; the program should not be developed with the sole perspective of instructing the general education population and students with disabilities are merely afterthoughts. Rather, once each and every student is accounted for in the early curriculum development stages, differentiation will take care of unique needs. Furthermore, the universal design approach can help instructors prepare all students to not only learn content, but can work to ensure that all students are given equal opportunity to practice higher order thinking

skills and literate thought on deeper levels (Michael & Trezek, 2006). This is an ideal for which educators, administrators, and curriculum developers are striving, but it tends to be difficult when translating this notion into the classroom.

Nonetheless, there are techniques available to make this a more successful experience for these struggling learners as well as for educators delivering the instruction. What makes present educational methodologies difficult for many students with disabilities is the way most information is presented, often referred to as "script literacy" processes through the use of written texts. Educators need to embrace more of a "multiple literacies" approach, which provides students with alternative ways to attain information. Technology is increasingly becoming more of a necessity to integrate into schools and also adheres to the "multiple literacies" perspective (Michael & Trezek, 2006).

Integrating technology into classroom instruction is a potential answer to this question of how to effectively teach students with disabilities. Recently, it was discovered that learners between the ages of eight and eighteen spend 10 hours and 45 minutes accessing media in a seven and a half hour day including utilizing multiple technologies at once (Smith & Okolo, 2010). As a result, it is not surprising that students would prefer to learn through technological vehicles. These students, referred to as "digital children" are clearly motivated by the medium of technology, and most are familiar with how to use technology, which when combined, makes academic material easier to grasp (Parette, Hourcade, Boeckmann, & Blum, 2008). Also, technology offers students the opportunity to transfer knowledge to other areas by allowing learners to practice skills through different channels other than traditional methods (Smith & Okolo, 2010). According to experimental studies, employing technological instruction has proved to be effective. The National Center for Supported eText (NCSeT) evaluates *eText*, a form of electronic text that alters font and includes internal supports, such as online dictionaries and supplemental resources. They have found that *eText* influenced positive outcomes in aiding students in the acquisition of specific literacy skills. Implementing videos, such as YouTube and TeacherTube, cameras, DVDs, and CDs have also been proven to significantly increase students' vocabulary and comprehension development in addition to activating their prior knowledge (Erickson, Hatch, & Clendon, 2010). Moreover, research associated with the *Computer-Assisted Collaborative Strategic Reading* (CACSR) program, which works to enhance comprehension for students with disabilities has showed that these students made significant gains when exposed to this technique (Kennedy & Deshler, 2010).

While the notion of incorporating technology into literacy instruction for students with specific learning needs has been accepted to have potentially positive outcomes, embedding this approach into routines begs certain questions. For example, it is important for research to discuss particular types of technology that are shown to augment students with disabilities' development as well as what aspects of literacy these devices address. Furthermore, it is necessary that educators understand how to combine technology into their literacy instruction without causing more harm than good. Prior to delving into these questions, however, it is significant to evaluate present issues instructional methodologies that use technology poses. Only from there can research work to resolve the surrounding questions of technology so that it can ultimately enhance the literacy development of students with special needs.

This paper presents a review of research that focuses on how technology is currently being used to aid students with disabilities in the development of literacy. After the need of rethinking successful literacy instruction for these students is discussed, the research hones in on potential issues educators encounter when implementing technology into routines prior to explaining how to do so within the RTI framework. Technological supports are not only discussed within these necessary guidelines, but the research also delves into technological resources that aid students in developing basic literacy skills, including reading and writing difficulties. Technology that specifically guides teachers in planning as well as including students in the general education curriculum are also evaluated through the ten studies. Lastly, the review concludes with how teachers can effectively marry technology with literacy instruction along with what technological aids are offered for older students. This research review is organized in this way to gain a comprehensive understanding of how these students with unique learning needs and special educators can be guided throughout the process of technological implementation. Based on these studies, conclusions are drawn in terms of what can be taken away as a whole from the review of research. Afterwards, implications for educators and paraprofessionals potentially working with these tools are provided to offer a practical understanding of the information discussed in these studies.

"Clearly, the literacy of yesterday is not the literacy of today, and it will not be the literacy of tomorrow" (Leu, 2000, p. 744).

Potential Problems of Integrating Technology into Instruction

Although technology has proved to be successful, it can be difficult to embed into instruction. Educators appear to be lacking in the necessary training required to access this technology successfully. Also, funding can present a problem and limit the amount and/or quality of the allowed technology (Smith & Okolo, 2010). Kennedy and Deshler (2010) explain that the ever-changing nature of both literacy and technology makes it hard to conduct research before aspects of either progress. Furthermore, RTI poses an added drawback. RTI is the primary instructional model in special education. It is a three-tiered model that impacts how educators teach and assess students. It emphasizes student evaluation in the form of universal screening and constant progress monitoring. Through this continuous assessment, students' needs are identified, monitored, and then given support through the tiers in which they fall. Technology can be difficult to fit in with the RTI model as a result of these tiers. There are certain questions as to what technology is most appropriate for each tiers, including the teacher training necessary to make knowledgeable decisions about the implementation at these levels (Kennedy & Deshler, 2010). Another key feature of RTI is the emphasis on using evidence-based practices. As a result of this, if researchers are having an arduous time keeping up with literacy and related technology as mentioned above, then they cannot provide the necessary evidence to meet RTI standards (Smith & Okolo, 2010).

Technology that Aligns with Best Practices

While obstacles do exist attempting to get the necessary empirical research, another issue rests in the amount technology is utilized for students with unique learning needs even though it

is proven that these students would reap the benefits the most. As a result of these issues, Smith and Okolo (2010) present ways that technology can be used that includes students with disabilities more while following RTI guidelines of what constitutes as best practice. In fact, it is believed that technology can even strengthen the effectiveness of RTI but in order to do this, it is imperative that educators and researchers evaluate what is already understood about successful instruction, and then connect it with technology. For example, the use of graphic organizers is a highly valued evidence-based practice for all learners and is especially effective for students with learning disabilities. Due to the fact that these students show difficulty in organizing information, graphic organizers can help them connect information so that they can visualize the relationship between what they learn as opposed to the material being disjointed facts. Studies conducted by Hall and Strangman (2002) and Gajria, Jitendra, Sood, and Sacks (2007) showed that there was an increase in ability for students with learning disabilities to take notes, comprehend, as seen through test scores, as well as participate in class using graphic organizers (Smith & Okolo, 2010). Technology can incorporate graphic organizers while offering an interactive alternative for these students. Programs, such as *Inspiration*, *Kidspiration*, *Webspiration*, and *FreeMind* have graphic organizers through technological means. It allows the educators to change the visual representation of the images and text, convert the information in a concept map to an outline, as well as include audio and text. Also, there are templates available for teachers to modify features based on students' individual needs.

Effective Writing Software Programs

In terms of written instruction, this is a significant area of academics that influences future success. However, NAEP has informed that in 2009, when compared to their peers, students with disabilities' writing skills differed in terms of quantity and quality. Their writing was disorganized and more simplistic in terms of sentence structure and word choice. These students' writing, in general, reflected issues with organization, strategies, vocabulary, spelling, revising, mechanics and thought regulation (Smith & Okolo, 2010). Through a meta-analysis, 11 successful methods of teaching and writing were identified. From these, three research-based experiments showed three characteristics of effective writing instruction for students with disabilities: directly teaching learners how to plan, revise, and edit their pieces, identifying specific goals for each assignment, and teaching them how to use word processing appropriately. There are several technology-based approaches that address these attributes while also following RTI guidelines including *Draft Builder* and *Co-writer*, which helps students organize their writing and guides them with spelling and grammar mistakes.

A similar program to this is *Ginger*, which identifies when a student misspells a word and predicts the word that he or she intended to use. *Science Writer* has prewriting templates, sentence starters, and can assist writers through the entire writing process in a particular content area. Learners can also take notes and ask questions to their teacher and/or peers. *Clicker 5* is a form of technology that places pictures over words, similar to *Boardmaker* and other picture-supported texts. Although this type of software can be difficult due to the complexity in creating pictures of abstract ideas, such as the words "do" and "is", it has been proven to allow students who cannot read at a functional level to still be able to take meaning away from the text and translate into their written activities (Erickson, Hatch, & Clendon, 2010).

Programs that Provide Explicit Instruction

Another aspect of RTI, as well as teaching students with disabilities includes educators providing explicit instruction. Direct instruction is at the center of RTI because learners gain information effectively by the teacher directly teaching them in a clear, structured manner. Studies show that this method of modeling, student practice, teacher feedback, and assessing their progress continuously is a highly effective approach for instructing students with learning needs. Technology that follows this methodology is *Simon Sound it Out*, iPhones, or iPads. These technologies can reinforce basic skills, such as phonics, while allowing teachers to monitor this data in order for them to provide additional assistance. Other programs, such as *First Words*, *Success Maker*, and *Waterford Early Learning Program* teaches vocabulary, tracks students' knowledge of words, and modifies instruction based off of student progress (Smith & Okolo, 2010).

Programs, such as *Tar Heel Reader* have beginning-level stories while also simplifying the harder texts. This allows books to be individualized and gives students the opportunity to grow on certain topics of interest while allowing teachers to create collections for their students. This has shown to help improve students' attention, which is an area from which many students with diverse learning needs suffer. Another current issue students with learning differences encounter is that they are often given more instruction with sight word development than any other aspect of literacy. The *Edmark Reading Program*, however, not only guides students in their decoding skills by converting the printed words into their oral representations, but it also allows them to explore other pertinent areas of literacy by helping them tend to the visual features of words, not necessarily their letter-sound correspondences. These programs also work to improve pupils' comprehension skills by presenting sequenced messages that help students learn how to retell stories in the appropriate order while also asking questions that develop higher order thinking skills. *Literacy through Unity*, *Tango to Literacy*, and *Accessible Literacy Learning Curriculum* also address literacy sills through helping students blend, segment and identify letter-sound associations, which tend to be difficult areas for students with disabilities to master. These programs are tailored to assisting students using a direct instruction approach to teaching that prevents them from advancing if they do not demonstrate proper understanding. The explicit teaching aspect of these programs is also highly supported by RTI principles of how to effectively educate students with disabilities (Erickson, Hatch, & Clendon, 2010).

Teacher-Support Software

Aside from specific programs that uphold RTI standards there are many assistive technology resources that are specific to literacy skill development while supporting teachers. A type of available software that has been proven to successfully teach students with disabilities is *MEville to WEville*. This program, along with others, such as *Word Maker* is highly supportive of teachers in that the lessons are aligned with the teachers' sequence of instruction. Many of these programs that provide teachers with additional support not only offers student data for teacher records, but also gives educators a framework to use technology as a form of instructional enhancement. This is an extremely valuable characteristic when considering setbacks teachers

typically face when using technology in the classroom. Studies also show that *MEville to WEville* increases student involvement while embedding shared reading activities, code-related interventions, parent/home connections, and language development. According to the National Early Literacy Panel (NELP) the abovementioned features of this program are highly correlated to later literacy success (Erickson, Hatch, & Clendon, 2010).

Technology that Provides Special Learners Access to Print

Other technology that is available for teachers to use when instructing students with specific learning needs focus their attention on building students' ability to access texts. For example, adapted books, alternative keyboards, talking word processors, and voice output communication devices were used in a classroom within a four month span and has been proven to increase students' concepts about print as well as their writing development by allowing them to hear words rather than accessing them solely through written means (Erickson, Hatch, & Clendon, 2010).

Higgins and Raskind (2005) also discuss an alternative way for students with disabilities to access print. It is mentioned that students with disabilities who have decoding issues spend most of their time on this aspect of reading, which makes it difficult for them to focus on comprehension. A form of technology referred to as Optical Character Recognition (OCR) converts print to audible speech. Educators are able to scan text onto a desktop computer, which allows it to then be read aloud to the student. However, OCR shifted to the *Reading Pen* electronic device due to the disadvantages OCR presented. While OCR was valued at $1,000-$2,000, the *Reading Pen* is only $275. Moreover, it can be easily transported to other learning contexts, such as home and school, which allows the student to practice and consistently use the device to compensate for their reading difficulties. Other features the *Reading Pen* offers is that it adjusts the rate, color, font, and background of the text while also highlighting sections of the text to bring students' attention to those areas. The *Reading Pen* was used in a study of ten students between the ages of 10 and 18. They were first given a comprehension test after they read silently. They were trained in using this device, practiced using the pen to decode words while reading independently and were then reevaluated through another comprehension assessment. Results showed a significant difference in favor of the pen use. Students were correct on seven more areas of the comprehension test through using the pen, and it also increased their standard scores by five (Higgins & Raskind, 2005).

Technology for Students with Physical Disabilities

Many students with disabilities are limited in their literacy attainment because of the gap of certain literacy skills, which prevents them from reading for meaning. However, technology can also account for physical disabilities students possess. Eye-scanning devices are available for these students who cannot use keyboards. Instead, they can point to letters rather than struggling with their fine-motor barriers (Erickson, Hatch, & Clendon, 2010). Alternative keyboards can also be used to change the standard QWERTY keyboard pattern to make the letters a different size and more familiar pattern. Keyboard filter technology can prevent students with physical challenges from clicking a letter too many times in a row by having a delay between the letters typed. Also, *Read-Write Gold* predicts words students are trying to compose based on the initial

letter or letters to make typing less laborious for students who lack certain motor strength. *Dragon Naturally Speaking* and *Dictate* have speech recognition features, which provides the students with the opportunity to use their voice as commands to open windows rather than their fingers (Caverly, 2008).

Technology for Learners with Disabilities and General Education Students

Although there are many technological software programs that are specifically adapted to students with disabilities, there are other forms of computerized instruction that not only can improve students in the general education population, but also students with disabilities who may or may not be mainstreamed with their differing peers. Virtual field trips can be accessed on the computer and can compensate for lack of funding in schools that prevent students from attending certain trips. Presently, this form of field trip caters to visual learners and also is available in real time so that students can ask experts questions as if they were actually there (Michael & Trezek, 2006). Web Quests are also gaining more popularity because it allows students to research topics that the teacher monitors, which provides students with learning needs additional assistance and individualization (King-Sears, Swanson, & Mainzer, 2011). Many schools are also beginning to supply Smart Boards in classrooms, which is simply an interactive whiteboard that allows students to manipulate the screen and control the features. Not only is this motivating, but it can also help students with fine-motor difficulties for if they cannot hold the Smart Board pens, they can use a tennis ball, for example, which will show up on the screen as well (Michael & Trezek, 2006).

In relation to computerized instruction, PowerPoint has also been a type of technology that has been proven to advance students with disabilities' literacy development while being less expensive. According to Coleman (2009), through a study that had students learn specific words through teacher instruction, teacher instruction and PowerPoint, and then just through PowerPoint alone, the pupils who were learning word patterns through PowerPoint identified the words in fewer trials than the remaining two groups. The advantages of using this method aside from the motivation factor, is that educators can upload pictures, make the text more animated, record voices, and also have positive reinforcement through verbal praise at certain points in the PowerPoint presentation. In terms of profound cognitive delays, PowerPoint can also be tailored to have switches for these students to change slides. While teachers can modify more difficult texts to create PowerPoint books, the switches may be easier than physically turning pages and also gives the teacher the chance to differentiate instruction more. PowerPoint can also be utilized for interactive storybooks, such as the "talking book", which eliminates learners from relying on fine motor skills at all, but can allow the teacher to record his or her own voice along with inserting comprehension questions at certain points in the story. Parette, Hourcade, Boeckmann, and Blum (2008) also conducted a study and found that in the Making a Difference Using Assistive Technology (MDAT) Project, PowerPoint was highly effective for teachers to expand the creative nature of their literacy instruction, and also improved struggling students' engagement when used in concurrence with direct instruction. Although PowerPoint can be used to teach a variety of literacy skills and concepts, in this study it had been found to improve vocabulary, comprehension, concepts about print, the alphabetic principle, and phonological awareness overall.

How to Effectively Incorporate Technology into Instruction

While all of these technological vehicles are available and have been proven to impact the learning of students with disabilities, educators still suffer in terms of how to integrate technology into their instructional routines. As a result of teachers requiring a great deal of guidance regarding this matter, Kennedy and Deshler (2010) present a conceptual framework for integrating literacy and technology in an RTI model for teaching students with disabilities. Certain principles should be understood regarding this integration including the deictic relationship between technology and literacy and how they are hard to define due to them continuously changing. Due to this, interventions incorporating technology should be implemented fairly quickly before they change. Teachers should also acknowledge the fact that learning is active, student-centered, and should involve theory-based instructional practices. It is imperative that educators have these prerequisite understandings prior to implementing technology into instruction so that they are not thoughtlessly using technology in a way that hinders rather than promotes learning.

Once educators accept the abovementioned understandings, there is an in-depth framework referred to as the Cognitive Theory of Multimedia Learning (CTML) that can walk teachers through the integration of technology and instruction. Presented by Mayer (2009), CTML is grounded in two theories that guide teachers in this process. The Cognitive Load Theory (CLT), which states that learning cannot occur when individuals' working memories are overloaded as well as the Dual Processing Theory (DPT), which explains that information can be embedded into students' minds through visual and auditory means. These two theories can help educators see that including technology in the classroom is rooted in accepted beliefs regarding what is understood about learning. A key component of CTML is the triarchic model of cognitive load, which has three elements consisting of limiting extraneous processing, managing essential processing, and fostering generative processing. This states that when instructing students with special needs, especially when using technology, it is essential to limit irrelevant academic interferences and other interruptions. Also, students with special needs learn better when the instruction is managed in a way that it is presented in short bursts rather than long segments. The technology component uses should also include means other than auditory; it should contain multiple learning style vehicles, such as visual and auditory access. This triarchic model of cognitive load is to help teachers use technology and their understanding of student learning so that they can support students' utmost learning potential (Kennedy and Deshler, 2010).

A concrete, practical, and accepted framework for the implementation of technology in the classroom that stems from CTML's rationale is referred to as the TECH framework. It supports the notion that assistive technology should be selected and monitored with care as well as used in conjunction with carefully selected instructional methodologies to create a comprehensive approach most beneficial to students with disabilities (Erickson, Hatch, & Clendon, 2010). Kennedy and Deshler (2010) explain that it is critical to choose technology that is supported by evidence and also agrees with current curriculum, standards, and individual learning needs. It is also imperative that teachers are highly trained in the technology they are

using so that they are familiar enough to utilize it effectively. Once the rationale behind technology in the classroom is fully understood, the TECH framework begins with targeting students' needs and the end result of the instruction. Next, the teacher should examine the technology available, how much it costs, how much training is required, and then should make the decision regarding which one to use. Afterwards, it is important that the students are given many opportunities to access the technology in addition to other activities; technology is not an activity in and of itself. Lastly, student progress should be monitored in terms of the success they showed through using the technological vehicle (King-Sears, Swanson, & Mainzer, 2011).

While this framework is an effective way to think about how to appropriately access technology in the classroom, Kennedy and Deshler (2010) explain that further research is required in terms of how to successfully educate teachers in this rationale so that they are proficient enough to carry out these understandings in a practical setting. It is also mentioned that when putting technology into realistic action, further research is necessary to highlight what technology is appropriate under different learning situations, such as content area and grade level along with what devices and/or software is most effective at these levels.

Technology for Higher Education

While this paper primarily focuses on younger learners with disabilities, students with special needs in higher education are often neglected. It is important for educators to gain a sense of how technology is progressing to meet the needs of these learners not for the reason that some day they might instruct these students, but that it is crucial for teachers to think about how they can better prepare their students for where they are headed and what they might encounter. In 2003, students with learning disabilities attending college represented 11% of the population of disabilities. 52% of the postsecondary disability population had issues that were print-related. Students with print disabilities, or those who cannot read print at an appropriate, functional level whether it is due to a physical ailment, such as blindness, or cognitive issues, such as information-processing problems, is problematic because students at this level are expected to access information at a more independent level prior to doing so in their careers (Wolfe & Lee, 2007).

Nevertheless, technology through alternative media vehicles can allow textbooks to be read aloud to students. Wolfe and Lee (2007) state that *eText* and the *Digital Accessible Information System (DAISY)* are examples of electronic texts that convert text to speech. While these devices are easy to transport, it is timely and costly to go through this conversion process. As a result, it is not made available to the high amount of students who are eligible for this modification. One study conducted by Elkind, Black, and Murray (1996) reported that speech synthesis devices, such as *eText* have proved to increase comprehension, attention, and fluency skills of students who are exposed to them. As a result of the need for audio texts to be present at higher academic levels, the Association of American Publishers (AAP) is attempting to make it more convenient for institutions to contact publishers for the specific type of permission required for their text files. Hopefully, this would allow for students to get the required readings in time for classes, and make the reading, and ultimately learning, process less arduous.

Summary and Conclusions

One conclusion that can be drawn from this review of research mentioned above is that there is a definite need for educators to rethink how to instruct students with disabilities so that they can perform successfully. This need is especially seen in the area of literacy based on students with disabilities' test scores compared to their peers. Although this realization is accepted, problems surrounding technological implementation for these students present multiple issues that deter educators from utilizing them, such as aligning them with evidence-based practices and the necessary, sometimes arduous, training that is required. These studies highlight another understanding that technology is, in fact, a way to motivate and enhance instruction for these struggling learners. A way to overcome the obstacles educators face is through evaluating these studies that showcase a plethora of software and other devices available that are compatible with RTI standards and are proven to increase students' reading and writing abilities when compared to traditional methods alone.

Furthermore, these studies draw on another conclusion that software can include teacher support resources to make the ease of using them more attractive. Along with teacher support, the research discussed describes technology that can be used for different types of learners from higher functioning to more severe. In this way, teachers can cater the technology that has been proven to be effective to meet the needs of all their learners whether they are teaching lower functioning students in a self-contained room, or students in an inclusive setting. While the research presents an assortment of technological support, it also aids educators in the transition of accessing this type of support in the classroom. Through the practical examination of a framework on which teachers can rely, they can better work towards effectively combining their literacy instructional practices with technological enhancements.

The last conclusion that can be drawn from the studies discussed in the research review is that there are technological methods to help students with literacy learning in their future. Through the technological support explained in the studies, teachers can gain a more in-depth understanding of where their students are headed and how they can better prepare them for their future academic endeavors.

Implications for Classroom Teachers and Paraprofessionals

Based on this research it is evident that technology is an effective way to improve instruction either in a self-contained or mainstreamed setting in a way that aids students with disabilities' literacy attainment. It can provide a more motivating method for instructing students on how to become successful readers and writers through building their organizational skills, practicing literacy skills while offering explicit instruction and feedback features for educators. Throughout the studies, it has been proven to increase literacy skills, such as phonemic awareness, writing conventions and organization, along with comprehension development.

While technology has been accepted as a feasible instructional enhancement, it is important for educators to take caution while using this type of tool. As a result of RTI being an

enforced guideline for special educators to follow, technology that is integrated into the curriculum should abide by RTI ideals, such as aligning with evidence-based and best practices. Moreover, applicable state standards and the school's curriculum should be kept in the forefront of teachers' minds so that it does not contradict or hinder these goals from being met. Schools may also be limited in terms of finances and training that is available for the technology to be embedded appropriately. Due to this, educators should conduct adequate research with more able others to decide the best route for beginning to use supplemental technology when teaching literacy.

Once these preliminary stages are thoroughly taken the teacher should utilize technology as a comprehensive approach in that it is in conjunction with their instruction, not as a substitute for it. It should also be used with knowledge that educators have regarding what already works. Erickson, Hatch, and Clendon (2010) explain how reading in general is still not fully understood. Due to this fact, educators need to use a combination of methods proven to be successful so they do not involuntarily prevent students from learning in ways that may or may not be currently recognized. Also, technology should be carefully integrated in a way that corresponds to students' needs, and with the desired outcomes in mind. For example, if a student has a difficult time learning a particular skill, such as blending, then the technology used should explicitly support this skill and not include other concepts that may interrupt or confuse the learning process. Lastly, it is imperative that educators using technology in their classrooms support learners and monitor their progress as well as the effectiveness of the technology itself. Devices and/or software should be differentiated for each student and adjusted based on his or her ever-changing needs. If these studies are taken into account, as well as the cautionary recommendations, then technology can impact instruction, teachers, and students in a way that aids in the learning process to ensure that students' skills are increased, not thwarted.

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